



OFFICE OF THE ARMED FORCES MEDICAL EXAMINER (OAFME)

Charles J. Stahl, III, M.D.
Armed Forces Medical Examiner, Distinguished Scientist
Date of Appointment - 1 October 1992

MISSION

The department is primarily responsible for multidisciplinary forensic (medicolegal) investigations of unnatural or violent deaths due to known or suspected accidents, homicide, suicide, or undetermined means. In these cases the OAFME must establish absolute identity, determine the cause and manner of death, and certify the death. This responsibility normally applies to:

- a. Members of the Armed Forces on active duty or on active duty for training.
- b. Civilians, including dependents of military members, whose deaths come under exclusive Federal jurisdiction. Deaths to be investigated include, but are not limited to, the following categories:
 - a. Unnatural or violent deaths from known or suspected accidents, homicide, suicide, or undetermined means.
 - b. Deaths directly or apparently related to the occupation or employment of the deceased and deaths of individuals enrolled in the Personnel Reliability Program.
 - c. Deaths related to vehicular, aircraft, or vessel accidents.
 - d. Sudden deaths not caused by readily recognizable disease.
 - e. Deaths possibly related to diseases that might constitute a threat to the public health.
 - f. Deaths occurring in a prison or the death of a prisoner.
 - g. Deaths of military crewmembers assigned to military aircraft or military vessels.
 - h. When the commander of the Military Medical Treatment Facility (MMTF) where the death occurred or the decedent's commander in the grade of O-4 or above notifies the OAFME that a medicolegal investigation on a military member is necessary for reasons of U.S. national security or for the protection of the military community.

The department reviews cases in consultation and conducts on-site medicolegal investigations, providing consultative as well as diagnostic services to the Department of Defense and other federal and nonfederal agencies. In addition, when requested and approved by higher authority, these services may be extended to foreign governments.

The OAFME is also responsible for education and research missions. There is an ongoing requirement to conduct training in forensic pathology, toxicology, anthropology, and DNA identifications for various agencies worldwide. This is accomplished through lectures, seminars, short courses, and a fully accredited one-year residency program in forensic pathology. Members of the department are also engaged in several ongoing research projects in such diverse fields as ballistics, forensic anthropology, detection of trace evidence utilizing monochromatic light sources, identification and reassociation of fragmented remains using DNA and other serologic techniques, and forensic toxicology.

ORGANIZATION

The department has seven divisions:

- a. Armed Forces Medical Examiner (AFME). This division performs the executive functions of the OAFME. Administrative and fiscal functions are provided by this division as well as oversight of all other OAFME division and regional and associate medical examiner functions and responsibilities under the Armed Forces Medical Examiner System (AFMES).
- b. Special Tactical Analytical Resources (STARS). This division serves as primary liaison between the department and other government agencies, both military and civilian, including the three military Air Safety Centers, NASA, FAA, NTSB, FBI, DEA, DOJ, BATF, and the State Department.
- c. Medicolegal Investigations Operations (OPS). This division is responsible for day-to-day OAFME operations to support worldwide forensic consultations and on-site investigations, including aircraft accidents.
- d. Forensic Toxicology. This division provides toxicology laboratory testing and consultation for OAFME investigations and for the Department of Defense drug-testing quality assurance program. It also provides education and research for these areas of pathology. The division is organized into four branches: the DoD Drug Testing Branch; the Forensic Toxicology Branch; the Research and Education Branch; and the Quality Assurance Branch.
- e. Education and Research. This division coordinates and facilitates all departmental education and research efforts.
- f. Department of Defense DNA Registry. This division encompasses the Armed Forces DNA Identification Laboratory (AFDIL), which is responsible for DNA-based identification of human remains for the Office of the Armed Forces Medical Examiner and to perform consultation, education, and research in the area of forensic DNA analyses. The division also maintains the DNA Specimen Repository for the Department of Defense.
- g. Special Investigations. This division is responsible for anthropological investigation and consultation for the OAFME. It also maintains the Trace Materials Analysis Laboratory for the purposes of aiding the OAFME in identification of materials associated with medicolegal investigations.

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THE ARMED FORCES MEDICAL EXAMINER

As the AFME, Dr. Stahl has continued to integrate the functions and responsibilities of the OAFME and the AFMES into a cohesive, efficient organization able to fulfill all aspects of the organizational mission. Dr. Stahl has maintained membership and/or involvement in multiple inter-, intra-, and extra-related DoD and AFIP organizations and committees as indicated below:

- Distinguished Scientist, American Registry of Pathology
- Program Director, Residency in Forensic Pathology
- Member, Graduate Medical Education Committee, AFIP
- Member, Search Committee for Director, Pathology Service, Veterans Health Administration, Department of Veterans Affairs
- Member, Strategic Planning and History of the Academy Committees, American Academy of Forensic Sciences
- Chairman, Board of Directors, National Association of Medical Examiners
- Member, Forensic Pathology Committee, College of American Pathologists
- Member, 1185b Review Board, Office of the Department of Defense Inspector General
- Chairman, Ad Hoc Committee on Bylaws, National Association of Medical Examiners
- Member, National Institute of Justice Working Group on Scene Investigations
- Member, Technical Advisory Committee for Firefighter Autopsy Protocol, United States Fire Administration

CONSULTATION

The OAFME accessioned 4,165 cases during CY 1995. Of these cases, 615 were forensic pathology consultations, 2,929 were forensic toxicology specimens, and 621 were DNA identification consultations.

Forensic Pathology Consultations

The OAFME accessioned 615 forensic medicolegal investigation consultations during CY 1995. There were 63 aircraft accident fatalities, 73% of which required on-site investigations. On-site investigation was also necessary for 13% of the remaining forensic consultations. There were 314 accidental deaths, which represent 51% of accessioned death cases. Approximately 20% of the accidental deaths were associated with aircraft mishaps. The recorded manners of death were accident 51%, natural 13%, homicide 8%, suicide 19%, and unclassified/pending 6%. These statistics do not include 2 combat-related deaths, 20 anthropological investigations, 31 trace materials investigations, 1 nonhuman investigation, and 14 nonfatal surgical consultations that were also reviewed during CY 1995.

were made to Delaware, Alaska, Alabama, Idaho, and Haiti. Exhumations were conducted in Georgia. Medical investigations usually require absolute identification, documentation of trauma and of preexisting medical conditions, determinations of cause and manner of death, certification of death, and correlation and reconstruction through on-site investigations. Subsequent to each investigation, a consultative report is prepared.

Anthropology Cases

The number of OAFME cases requiring specialized anthropological examinations remained greatly in demand from the previous year. Dr. Rodriguez continued to provide anthropological assistance to AFDIL and OAFME cases involving fragmented and commingled remains, as well as assistance to other agencies. Dr. Rodriguez also provided consultation to both the D.C. and Maryland State Medical Examiners' Offices. These consultations included examination of human remains and local scene investigation. Notable CY 1995 cases of anthropologic significance follow:

- National Transportation Safety Board - Dr. Rodriguez was involved in the continuing examination and identification of victims of the U.S. Air 727 air crash near Pittsburgh, Pa. This crash received international publicity, most notably for the carnage inflicted and the identification skills of the processing team.
- C-120 crash, Homestead Air Force Base, Bliss, Idaho, and AWAC crash, Elmendorf Air Force Base, Anchorage, Alaska - Dr. Rodriguez was involved in the examination and identification of victims of these crashes involving U.S. Air Force planes and personnel. These crashes received nationwide publicity, most notably for the type of aircraft involved and the manner in which the crashes occurred.

This division also participated in a number of investigations requiring trace materials analysis, a new function of the Special Investigations Division.

TYPE of CASE	SOURCE of CASE
Anthropologic 20	Military 11
	Civilian 6
	Federal 3
Trace Materials 31	Military 31
	Civilian 0
TOTAL 51	TOTAL 51

The Special Investigations Division was also represented on a number of televised documentaries and specials. The most notable program follows:

- Dr. Rodriguez appeared in a British Broadcasting Company (BBC) television documentary on *The Use of Animals and Plants in Death Investigation*. This film previewed in Europe, the Middle East, and Asia in 1994, and was broadcast nationwide in the U.S. in 1995.

Toxicology Cases

The Forensic Toxicology Division processed and reported 2,929 cases, with 6.8 days average turnaround time. The clinical workload decreased 26% in CY 1995 due to cessation of postmortem casework for the District of Columbia. This drop was offset in 1992 with a 45% increase, which remained at that level for 1993 and dropped only slightly (16%) in 1994. The turnaround time for results remained under 10 days. An anticipated increase is expected for CY 1996 due to the downsizing and closure of other military laboratories.

TYPE of CASE	SOURCE of CASE
Aircraft Incidents 1,669	USAF 793
Air Fatalities 132	USA 985
Clinicals 554	USN 536
Quality Controls 141	FAA 55
Forensics 433	MC 25
	CG..... 51
	Civilian 117
	Canada 34
	Other 333
TOTAL 2,929	TOTAL 2,929

AFDIL Cases

Service and Genetic Systems Branch

The Service and Genetic Systems Branch of the Armed Forces DNA Identification Laboratory (AFDIL) processed 621 new cases in CY 1995, accounting for 1,574 new AFIP accessions. A total of 970 final reports were submitted: 918 CY 1995 cases, 24 CY 1994 cases, 18 CY 1993 cases, and 10 CY 1992 cases.

Of the 621 AFDIL cases, 139 represented military and civilian cases (128 and 11, respectively). The 128 military cases can be divided into two groups. Eighty-eight of the cases were submitted by the Central Identification Laboratory, Hawaii (CILHI). These cases involved the identification of human skeletal remains from previous conflicts (e.g., Vietnam, Korea, and World War II). In CY 1995, final DNA testing was reported on 56 CILHI cases; 14 resulted in an identification, 1 resulted in an exclusion, and 4 provided no results. As of 1 December 1995, a total of 40 cases were still awaiting family references for comparison purposes. These cases represent the potential for greater than 100 identifications in CY 1996. Finally, there were 33 cases in active status and 35 in backlog status, as of 1 December 1995.

In addition to completing the DNA analysis of the cases for CILHI, AFDIL staff members accompanied the Navy Mortuary Affairs staff during their notification of eight families. During these notifications the families are presented with detailed information on their particular case and the identification methods used. Primary identification of the cases involved mitochondrial DNA (MtDNA) testing.

The remaining 40 military cases were submitted through the Office of the Armed Forces Medical Examiner (OAFME) and other military sources. AFDIL provided DNA testing for the OAFME in a number of high-profile cases that included the Alexander City, Alabama crash, in April 1995, of a USAF C-21, which killed 8 individuals, including Clark G. Fiester (Assistant Secretary of the Air Force) and MG Glenn A. Profitt II; the Bliss, Idaho crash of a USAF C-130, in May 1995, which killed 6 individuals; and the Anchorage, Alaska crash of an USAF E-3 AWACS, in September 1995, which killed 24 individuals (22 US/2 Canadian service members). AFDIL continues to provide turnaround times of 24 to 48 hours (verbal confirmation) for high-priority cases involving nuclear DNA testing.

There were three civilian cases completed in CY 1995 that gave AFDIL national and international notoriety. The first case involved the identification of the last Russian Tsar, Nicholas Romanov II. The Tsar was identified using MtDNA sequence analysis and comparison of the profile to that of the Tsar's brother, Georgij Romanov; Georgij's remains were exhumed in 1994. Georgij Romanov died in 1899 and was buried in St. Petersburg, Russia. The Tsar and his brother shared a rare

sequence profile which, when combined with other physical and circumstantial data, provided indisputable evidence for identification of the Tsar. The results of this case were featured in dozens of newspaper articles across the country to include *New Yorker* magazine and *Reader's Digest*. The Romanov story itself has been the subject of numerous books and novels, including Robert K. Massie's book, *The Romanovs, The Final Chapter*.

The second notable civilian case involved identification of a human fingernail found at the scene of one of the most brutal murder cases in the state of Texas; the case had been open since 1982. The case involved a robbery/execution of five individuals that took place at a Kentucky Fred Chicken food outlet. The evidentiary testing involved a piece of fingernail found on one of the victims. An extensive research study was performed on human fingernails prior to working on the case. This resulted in a firm understanding of what to expect when dealing with fingernails and a comprehensive protocol for extraction of DNA from fingernails. The mitochondrial and nuclear DNA profiles of the fingernail were compared to the suspect, and an exclusion was made. The suspect, who was arrested in April 1995, was released in November 1995. This case illustrates the power of DNA testing to not only implicate an individual in a crime but also to exonerate an apparently innocent individual.

The last civilian case involved the identification of human skeletal remains returned by Iraq to Kuwait and presumed to be a Kuwait citizen killed during Operation Desert Storm. The Kuwaiti government requested the assistance of the AFIP and AFDIL to use DNA testing methods to identify the remains. Nuclear DNA markers were used to associate the remains to immediate family members. The results strongly supported the identification of the remains.

Thirty AFDIL cases submitted in CY 1995 were proficiency tests. AFDIL currently has 14 DNA analysts and 8 DNA technologists or technicians. These staff members are required by forensic standards to perform proficiency testing twice each year, one of which must be from an outside proficiency test provider.

Twelve AFDIL cases represented quality control of the DoD DNA Specimen Repository. Each case involved testing of 100 bloodstain cards, randomly selected each month and typed using one of the AFDIL DNA typing systems; this work was done in conjunction with the National Institute of Standards and Technology (NIST). AFIP accession numbers were generated on 602 of these specimens. In the future, all QC samples will be given an AFIP accession number.

The final 440 AFDIL cases represent blood collections from POW/MIA family members. These specimens are used for comparison purposes for the identification of individuals unaccounted for from previous military conflicts.

Advanced DNA Technologies Development Branch

No consultations were performed during CY 1995.

DoD DNA Specimen Repository

The DoD DNA Specimen Repository provided 39 reference specimens to the Service and Genetic Systems Branch for human remains identification during CY 1995. The repository is continuing to collect DNA reference specimens from all new accessions, active and reserve components, deployable DoD civilians, and civilian contractors. No service member is to be deployed to a hostile fire zone without a DNA reference specimen on file in the repository. The reserve component began collections in earnest in CY 1995, and the National Guard will begin in CY 1996. Collections in CY 1995 were made for personnel deploying to Haiti, Bosnia, Southwest Asia, and Latin America. Collections are on track and to be completed by the active component in CY 1998 and the reserve component in CY 2001.

The DoD DNA Specimen Repository received 567,000 specimens in CY 1995 and but only accessioned 530,000 specimens due to duplication of specimens, lack of information or blood on the bloodstain card, and service members not entered into the Defense Eligibility Enrollment Database (DEERS). The repository, as of 31 December 1995, has accessioned 1,150,000 speci-

mens. The backlog that was carried over from CY 1994 has been eliminated. The revised Specimen Management System (SMS) has continued to increase production. On-line capability with DEERS will be available to the repository beginning in January 1996, which will further increase production. The repository continues to need additional space; new freezers will be installed in 1996 that are capable of holding 1.5 million specimens. Additional space for buccal swabs will also have to be acquired in CY 1996. In June 1995, the DoD General Counsel approved publication of the systems notice concerning the DNA Registry in the Federal Register. The notice was published 14 June 1995. No comments were received from the public concerning the notice.

TYPE OF CASES BY AFDIL CASE #/AFIP ACCESSION #

DNA Identity Testing	139 / 204
Proficiency Testing	30 / 30
Quality Control/DNA Repository	12 / 900
POW/MIA Family References	440 / 440
TOTAL	621 / 1,574

SOURCE OF CASES BY AFDIL CASE #/AFIP ACCESSION #

OAFME	30 / 80
CILHI	88 / 89
Outside Agencies	21 / 35
Cellmark Proficiency Tests	4 / 4
CAP Proficiency Tests	20 / 20
Other Proficiency Tests	6 / 6
Repository QC	12 / 900
POW/MIA Family Reference Collections	440 / 440
TOTAL	621 / 1,574

DNA Registry

During CY 1995, the Department of Defense DNA Registry continued its support of ongoing missions of the Armed Forces Medical Examiner's Office (OAFME) in the areas of consultation, education, and research. October 1995 was a milestone for the registry as it marked the first anniversary of full production for the laboratory in support of the US Army Central Identification Laboratory, Hawaii (CILHI). The DNA Registry, as of December 1995, has 66 military, GS civilian, and American Registry of Pathology personnel staffing its many functions. Funding for the operation comes not only from Defense Health Program (DHP) funds, but also from funds provided directly from the U.S. Army Deputy Chief of Staff for Personnel to support CILHI-related mission functions.

The DNA Registry operates from two facilities:

- the Gillette Building, located at 1413 Research Blvd, Rockville, Md. This facility is used by the administrative section of the registry, as well as the laboratories of the Service and Genetic Systems Branch and the Advanced DNA Technologies Development Branch. This facility encompasses approximately 33,000 sq ft.

- the UPS Building, located at 16050 Industrial Drive, Gaithersburg, Md. This facility houses the DoD DNA Specimen Repository and encompasses approximately 6,000 sq ft of processing and storage space.

The following are highlights of the DoD DNA Registry for CY 1995:

- The Defense Science Board - Due to the moratorium imposed by the DoD on the use of mitochondrial DNA analysis for identification in January 1994, the Defense POW-MIA Office (DPMO) sponsored a Defense Science Board (DSB), chaired by Nobel Laureate, Dr. Joshua Lederberg of Rockefeller University. The DSB held its final meeting in January of 1995. On 6 July 1995, the DSB issued its final report supporting the use of DNA technology for identification of ancient remains. On 18 July 1995, the DoD imposed moratorium was lifted by the Assistant Secretary of the Army (Manpower and Reserve Affairs).
- Marine Corps Challenge to DNA Collections - DNA collections have taken place since June 1992, when collections were initiated at Fort Knox, Ky. In January 1995, two USMC personnel, LCPL John Mayfield and CPL Joseph Vlacovsky, refused to provide DNA specimens prior to a deployment exercise. Court-martial proceedings were initiated against the two Marines. The military judge eventually dismissed the charges; however, the Marine Corps is appealing the ruling. Mayfield and Vlacovsky also sought an injunction to have the Federal Government cease DNA collections from current USMC and Navy service members. The U.S. District Court, on 19 July 1995, denied the plaintiffs' motion for summary judgement, upholding the Federal Government's right to make DNA collections. The action is currently under appeal to the Ninth Circuit Court of Appeals. The Department of Justice is representing the DoD in the appellate action.
- Acceptance of Outside Casework - With the continued improvement of both its nuclear and mitochondrial DNA testing capabilities, the DoD DNA Registry has received numerous requests from not only the United States but also worldwide to assist in using its cutting-edge DNA technology in various case settings that include not only identification of victims but also suspects. At the request of Mr. Togo West, the Secretary of the Army, the AFDIL accepted a 13-year-old homicide case from the State of Texas. Due to the circumstances of the case and the involvement of Mr. West, a proposal was presented to the AFIP Board of Governors and the Assistant Secretary of Defense (Health Affairs) for acceptance criteria of these outside cases. The BOG approved the involvement of the AFDIL in outside cases, with the ASD(HA) responsible for oversight and coordination, as appropriate.
- Korean War Remains - There are over 8,100 American service members whose remains were never returned or identified from the Korean conflict. Of these 8,100 service members, 865 are buried as unknowns in Hawaii. Since 1990, the North Koreans have turned over to United Nations control the reported remains of approximately 208 American service members. To date, only five of these 208 have been identified due to the lack of adequate records and poor recovery techniques employed by the Korean People's Army (KPA). Many of these cases will require DNA for identification. Over the past year, CILHI has forwarded 10 of these cases to the AFDIL for analysis. As negotiations with the KPA continues, the DNA Registry has developed plans for scaling up to meet this potential requirement. Plans include an implementation of a family outreach program and then expansion to a large-scale remains testing program.
- 26th Annual National League of Families Meeting - For the fourth year, the DoD DNA Registry participated in government briefs as part of the 26th Annual Meeting of the National League of Families of American Prisoners and Missing in Southeast Asia, which was held at the Crystal Gateway Hotel, 20-22 July 1995. Presentations were made by LTC Victor Weedn and Ms. Rhonda Roby. Over 100 family reference collection kits were provided to family members who wished to donate a DNA specimen. The DNA Registry had a booth where family members and interested participants could see the work being accomplished by the AFDIL.

- **Korean Cold War Family Briefing** - In conjunction with the dedication of the Korean War Veterans Memorial in Washington, D.C., on 27 July 1995, the Defense POW/MIA Office (DPMO) sponsored a briefing for the family members of the 8,100 unaccounted-for service members from the Korean conflict concerning ongoing efforts with the government of North Korea. The briefing was held on 28 July 1995, at the Crystal City Marriott. The DoD DNA Registry presented on the work currently being accomplished by the AFDIL. Ten AFDIL staff members were present at a booth display to answer questions from family members and provide family reference specimen collection kits.
- **US-Russian Joint Commission (USRJC)** - The USRJC was established in March 1992, to assist in learning the fate of missing American servicemen in the former Soviet Union. Their efforts have helped recover detailed information concerning missing Americans. Recently, the USRJC was instrumental in uncovering details of the shootdown of an American RB-29 in 1954, which led to the subsequent identification of one of the pilots using mitochondrial DNA. On 20 September 1995, at the request of the Defense POW/MIA Office, the DoD DNA Registry hosted a briefing and tour for MG Antoly Volkov, deputy chairman; Colonel Sergey Osipov, secretary; and Mr. Vladimir Pruamukhin, members of the USRJC, concerning the DNA Registry's involvement in casualty identification.
- **DoD Casualty Affairs** - The DoD DNA Registry hosted the quarterly DoD Casualty Affairs Conference, 17-18 October 1995. This conference brings together all major stakeholders of the DoD involved in the casualty process. Over 40 personnel participated to include members from the Army, Navy, and Air Force casualty and mortuary services, the Joint Staff, OSD Public Affairs, CINCPAC, Joint Task Force - Full Accounting, the Army Central Identification Laboratory, and the Defense POW/MIA Office.
- **Patent Infringement Case** - A civil suit has been filed in federal court for infringement of patent rights held by an individual concerning the DNA collection kits used by DoD in the collection of specimens from service members. The Department of Justice is representing the DoD in this action.
- **Process Action Team** - In June 1993, the Army Surgeon General, LTG Alcide M. LaNoue, directed the establishment of a Process Action Team (PAT) to identify current and future uses for genetic services and consideration of consolidation of genetic services within DoD. LTC Victor Weedn was appointed special duty officer to lead the PAT. Various stakeholders within the Federal Government were identified, briefed, and solicited to appoint representatives to the PAT. These included the military services, U.S. Coast Guard, Veterans Affairs, and the U.S. Public Health Service. The PAT convened its initial meeting in February 1995, and has met monthly to discuss a diverse array of issues concerning centralization of clinical genetic services, laboratory testing, applications to operational military issues, genetic research, and ethical considerations. The PAT's objective is to provide a final report of actions by January 1996.

During CY 1995, the DNA Registry responded to numerous requests for interviews from the press and publication of the following articles:

- *The Pentagon*, 26 April 1995, "Lab Identifies Remains Through DNA - Modern Procedures Give Hope for End of Unknown Soldiers"
- *U.S. Medicine*, May 1995, "DNA Registry: Powerful Identifier"
- *Army Times*, 19 June 1995, "Two Win Round In DNA Case"
- *The Washington Post*, September 5, 1995, "Pinning Down A Romanov"
- *U.S. Medicine*, October 1995, "Sleuths From AFIP Help Solve Romanov Mystery"
- *USA Today*, 1 September 1995, "DNA Deletes Doubt About Czar Nicholas"
- *The Montgomery Gazette*, 10 November 1995, "A Link To The Past"
- *Reader's Digest*, December 1995, "Last Mystery of the Czar"

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The following interviews were given for television stories:

- KGMB-TV, Honolulu, Hawaii, 26 May 1995, "DNA Testing By the DoD"
- Russian TV News, "Ostankino," 23 August 1995
- Armed Forces Radio & TV, Two-Minute Report, 25 September 1995, "DNA Identification"
- Italian TV Special, 27 September 1995
- Discovery Channel Special, Three-Part Series, 8 December 1995
- CBS Evening News, 4 December 1995, "Eye on America - DNA Dogtags"

EDUCATION

The department presented six formal AFIP short courses during CY 1995. The OAFME participated in national educational meetings of organizations, including the American Academy of Forensic Sciences, the National Association of Medical Examiners, and the Aerospace Medical Association.

Forensic Pathology

The OAFME conducted four AFIP/ARP short courses during CY 1995. The department directs a 1-year forensic pathology residency and provides faculty for the George Washington University Master of Forensic Science Graduate Program. The department also provided training to rotating medical students and resident physicians. In CY 1995, two military pathologists successfully completed the 1-year forensic residency training program. No military pathologists started the residency for academic year 1995-1996. The staff also conducts a continuing education program for the department, with lectures presented twice a week.

Two USUHS medical students completed a 4-week rotation in the OAFME. Four military medical officers completed residency rotations in the OAFME. A U.S. Public Health Service pathologist continued part-time with the staff in order to satisfy the requirements for maintenance of primary medical specialty skills. One reserve officer completed active duty for training with the OAFME this CY.

The OAFME continued residency training agreements with the chief medical examiners of the District of Columbia, the State of Maryland, and the Commonwealth of Virginia. Departmental flight surgeons gave 3- to 4-hour lectures on aviation pathology and aircraft accident investigation to Army, Navy, and Air Force flight surgeon classes at Fort Rucker, Ala., Pensacola, Fla., and Brooks Air Force Base, Texas, respectively. Lectures were presented at various federal, state, international, and civilian organizations.

Forensic Anthropology

The forensic anthropologist and Distinguished Scientist, William C. Rodríguez, Ph.D., participated in numerous formal courses presented by the OAFME and other AFIP departments. Dr. Rodríguez also presented many lectures as parts of courses sponsored by educational and law enforcement agencies. In 1993, Dr. Rodríguez was elected as vice president of the American Board of Anthropology. HMCS(SS) Erich Junger, USN, serves as an associate professor at Northern Virginia Community College, Woodbridge, Va., where he teaches "Introduction to Criminalistics."

Forensic Toxicology

The division offered continuing education in drug testing and other toxicologic analyses to military residents in forensic pathology, George Washington University Forensic Science fellows, US Army Reserve chemists, US Army West Point Cadets, University of Maryland students, and drug-testing analysts throughout the year. In-house and AFIP continuing education on various subjects totaled 379 hours.

AFDIL

The AFDIL participated in or conducted a number of AFIP/ARP courses during CY 1995. In addition, the AFDIL taught a full-semester graduate course on DNA Profiling for the George Washington University Forensic Sciences Department. During CY 1995, the AFDIL received numerous visitors, distinguished guests, scientists, and students. An unprecedented number of international visitors

participated in projects and in-house training during their tenure. Some of these visits included a delegation from Kuwait, seeking information on identification of casualties during the Gulf War; a physician with the Greek Air Force, interested in the criteria for establishing a laboratory such as AFDIL; forensic scientists from Germany who trained on D1S80 and STRs; and an investigator from Costa Rica, working on a murder case. A landmark international visit resulted in a joint project with the Russian DNA expert, Dr. Pavel Ivanov, and concluded with the definitive identification of the remains of Czar Nicholas II and his entourage. The long-awaited and controversial identification process even prompted a visit from the acclaimed historic author, Robert K. Massie, known for his book *Nicholas and Alexandra*. AFDIL also hosted five GWU forensic science students, three students from the George Washington University/DoD Summer Intern Program, two cadets from the U.S. Military Academy, West Point, and other members from the forensic community who received training in DNA techniques and procedures used in the laboratory. Several visiting scientists are working on long-term projects at the AFDIL, under memorandums of agreement with universities, other laboratories, and outside agencies.

Continuing Education

The department participated in or conducted the following AFIP/ARP short courses during CY 1995:

- AFIP Forensic Dentistry Course, 15-16 Mar, Bethesda, Md.
- AFIP Advanced Forensic Pathology Course, 24-28 Apr, Quantico, Va.
- AFIP Methods and Advanced Techniques in Human Identification, 9-13 May, Bethesda, Md.
- AFIP Forensic Anthropology Course, 17-21 July, Bethesda, Md.
- AFIP Basic Forensic Pathology Course, 2-6 Oct, Rockville, Md.
- DNA Databanks and Repositories, 2 days, St. Paul, Minn.

The department conducted the following courses during CY 1995:

- George Washington University courses supporting the Master in Forensic Science Program. OAFME staff provided lectures for 6 semester hours of course credit. The lecture series involved basic physiology and forensic medicine (14 students in first semester, 11 students in second semester - Each semester included 5 military fellows).
- FBI National Academy Field Training Course - Detection and Recovery of Human Remains - Quantico, Va., codirector, 6 days.
- George Washington University course in Forensic DNA Typing, 3 semester hours.
- Introduction to Criminalistics, Northern Virginia Community College, Woodbridge, Va.

Lectures

Staff members of the OAFME presented the following lectures as parts of courses organized and directed by the AFIP or other agencies:

1. Jan 95: Georgetown Medical School, Dept. of Anatomic Pathology, Washington, D.C., "Forensic Anthropology and Time Since Death Determinations," Rodríguez WC.
2. Jan 95: Glyncro, Ga., FLETC/ATF Bomb Course, "Forensic Pathology of Bombs and Explosives," Cogswell SA.
3. Jan 95: Stanford, Calif., Advanced Research Project Agency Meeting, "Micro- Electro-Mechanical Systems Technology For DNA Analysis," Weedn VW.
4. Jan 95: Quantico, Va., FBI Academy, The Technical Working Group on DNA Analysis Methods (TWGDAM), "AFIP Update on Mitochondrial DNA Testing," Holland MM.
5. Jan 95: Bethesda, Md., Uniformed Services University of the Health Sciences, "DNA Applications for Forensic Pathology," Weedn VW.
6. Feb 95: Quantico, Va., FBI/ VICAP Advanced Homicide Investigation Course, FBI Academy, "Forensic Anthropology," Rodríguez WC.
7. Feb 95: Bethesda, Md., Uniformed Services University of the Health Sciences, "DNA Applications for Forensic Pathology," Weedn VW.

8. Feb 95: Greenbelt, Md., Consortium for Inter-American Trade and Development--National Agricultural Library, "Workshop on Development of Clinical Genome Service," Weedn VW.
9. Feb 95: San Juan, Puerto Rico, University of Puerto Rico, "DNA Fingerprinting," Weedn VW.
10. Feb 95: Gaithersburg, Md., Watkins Mill Elementary School, "Fingerprinting & Forensic Sciences," Anderson TD.
11. Feb 95: Oklahoma City, Okla., Federal Aviation Administration Meeting, "Modern Techniques of Identification," Huffine EF.
12. Mar 95: Rockville, Md., Goucher College, "Overview of the DoD DNA Registry: DNA Analysis," Roby RK.
13. Mar 95: Baltimore, Md., University of Maryland at Baltimore County, School of Medicine, Division of Human Genetics, "Current Projects of the Advanced DNA Technologies Development Branch," Belgrader P.
14. Mar 95: Laytonsville, Md., Microscopic Exhibition, Laytonsville Elementary School, Weedn VW.
15. Mar 95: Toronto, Canada, IAP Meeting--Special Course, "Molecular Pathology 95," Weedn VW.
16. Mar 95: Royal Oak, Mich., DNA Technology in Clinical Laboratory, Fourth Annual Symposium, "Molecular Tools for Human Identification," Weedn VW.
17. Mar 95: Washington, D.C., Presentation for the Smithsonian Institute, "Forensic Science in Criminal Investigation," Weedn VW.
18. Mar 95: Brooks AFB Texas, Aerospace Medicine Primary Course, "Aviation Pathology," Gormley WT.
19. Apr 95: Quantico, Va., FBI Academy, Advanced Forensic Pathology Course, "Management of the Crime Scene," Stahl CJ.
20. Apr 95: Quantico, Va., FBI Academy, Advanced Forensic Course, "Panel Discussion: Standards, Accreditation and Quality Assurance in Medical Examiner/ Coroner Systems," Stahl CJ.
21. Apr 95: Virginia Beach, Va., Virginia, Homicide Investigators Association Symposium, "Keynote Speaker: Quality Management of Crime Scene Investigations," Stahl CJ.
22. Apr 95: Quantico, Va., AFIP Advanced Forensic Pathology Course, "Remains Processing and Identification," Rodríguez WC.
23. Apr 95: Quantico, Va., AFIP Advanced Forensic Pathology Course, "DNA Identification," Holland MM.
24. Apr 95: Quantico, Va., AFIP Advanced Forensic Pathology Course, "Forensic Entomology and Trace Materials Laboratory - An Introduction," Rodríguez WC, Junger EP.
25. Apr 95: Quantico, Va., AFIP Advanced Forensic Pathology Course, "Orientation to Outdoor Crime Scene Processing," Rodríguez WC.
26. Apr 95: Quantico, Va., AFIP Advanced Forensic Pathology Course, "Body Location Techniques and Surface Recovery," Stahl CJ, Rodríguez WC, Junger EP, Burns AC.
27. Apr 95: Quantico, Va., AFIP Advanced Forensic Pathology Course, "Burial Recovery and Evidence Collection," Stahl CJ, Rodríguez WC, Junger EP, Burns AC.
28. Apr 95: Quantico, Va., AFIP Advanced Forensic Pathology Course, "Management of the Crime Scene," Stahl CJ.
29. Apr 95: Quantico, Va., AFIP Advanced Forensic Pathology Course, "Lasers and Alternative Light Sources," Junger EP.
30. Apr 95: Washington, D.C., Presentation at the Armed Forces Institute of Pathology, "ARP Student Symposium," Weedn VW.
31. Apr 95: Raleigh, N.C., North Carolina State University, Department of Genetics, "DoD DNA Registry," Weedn VW.
32. Apr 95: Rockville, Md., FDA, Department of Health and Human Services, "The Role of Molecular

- Genetics in Forensic Science: New Technologies & Regulatory Issues,” Holland MM.
33. Apr 95: Gettysburg, Pa., Gettysburg College, “DNA Testing in the Forensic Sciences: An Overview,” Holland MM.
 34. May 95: West Trenton, N.J., The New Jersey Association of Forensic Scientists, “Mitochondrial DNA in Forensic Identity Testing: Case Examples and Quality Assurance,” Holland MM.
 35. May 95: Wheaton, Md., John F. Kennedy High School, “DNA in Crime,” Holland JS.
 36. May 95: Brookeville, Md., Brooke Grove Elementary School, “Fingerprinting in Forensic Sciences,” Freeman PG.
 37. May 95: Fairfax, Va., Thomas Jefferson High School for Science and Technology, “Overview of AFDIL and AFIP,” Kupferschmid TD.
 38. May 95: Anchorage, Alaska, Northwest Association of Forensic Scientists and Alaska Peace Officers Association, “Mitochondrial DNA Sequence Analysis of Skeletal Remains from a World War II Incident,” Wadhams MJ, coauthors.
 39. May 95: American Chemical Society, Washington, D.C., “Sequencing of Mitochondrial DNA for Identification of Human Remains,” Roby RK.
 40. May 95: Walnut Creek, Calif., The California Association of Criminalists, “Basics of DNA Sequencing: Use of Mitochondrial DNA for Human Remains Identification,” Roby RK.
 41. May 95: Walnut Creek, Calif., The California Association of Criminalists, “Mitochondrial DNA Case Examples: The Importance of QA in Mitochondrial DNA Testing,” Roby RK.
 42. May 95: Walnut Creek, Calif., The California Association of Criminalists, “Nuclear and Mitochondrial DNA Analysis of Decomposed Human Remains,” Morgan MA.
 43. May 95: Washington, D.C., Novel Amplification Technologies/Experimental Design in Automation/Biochip Array Technologies: IBC USA Conferences, “Automated DNA Purification and Amplification,” Belgrader P, Devaney J, Del Rio S, Weaver K, Marino M.
 44. May 95: Washington, D.C., American Chemical Society 29th Middle Atlantic Regional Meeting, “Characterization of Human Genomic DNA Using Short Arbitrary Oligonucleotide Primers Analyzed by Capillary Electrophoresis,” Marino M, Devaney J, Del Rio S, Weaver K, Belgrader P.
 45. May 95: Silver Spring, Md., Combat Casualty Care Conference, “Field DNA Testing,” Weedn VW.
 46. May 95: Brooks AFB Texas, Medical Investigation of Aircraft Mishaps, “Aviation Pathology,” Gormley WT.
 47. May 95: Annual Harvard Police Science - Death Investigation Seminar, Baltimore, Md., “Overview of Forensic Anthropology,” Rodriguez WC.
 48. May 95: Beltsville, Md., Center for Veterinary Medicine, Food and Drug Administration, “Criteria for Sample Identification Using GC/MS,” Smith ML.
 49. June 95: Bethesda, Md., National Chapter AMSUS Chapter, “The DoD DNA Registry,” Weedn VW.
 50. June 95: Rockville, Md., The Red Cross, “The Application of Molecular Genetics to Forensic Identity Testing,” Holland MM.
 51. June 95: Maryland Society of Histotechnologists, Annapolis, Md., “The Search for Anastasia,” Roby RK, Barritt SM.
 52. July 95: Bethesda, Md., Forensic Anthropology Course, Armed Forces Institute of Pathology, “DNA in Forensic Anthropology Cases,” Roby RK.
 53. July 95: Oxford, England, UK, Ancient DNA III, “Comparison of DNA Extraction Methods from Ancient or Degraded Bone,” Parsons TJ.
 54. July 95: Crystal City, Va., League of Families Meeting, Weedn VW, Roby RK.
 55. July 95: Crystal City, Va., Korean and Cold War Families Briefing, Weedn VW.

56. July 95: U.S. Attorneys Office Annual Homicide School, Washington, D.C., "Forensic Death Investigation," Rodríguez WC.
57. Aug 95: Brooks AFB, Texas, Aerospace Medicine Primary Course, "Aviation Pathology," Gormley WT.
58. Aug 95: Washington, D.C., Analytical and Molecular Biological Techniques in Environmental Toxicology and Pathology Conference, "Forensic DNA Identification," Weedn VW.
59. Aug 95: Oklahoma City, Okla., Oklahoma State Bureau of Investigation, "Forensic DNA Testing: Today and Tomorrow," Roby RK.
60. Sept 95: Washington, D.C., FBI Headquarters, "The Use of DNA Testing for Human Remains Identification in the Military," Holland MM.
61. Sept 95: Bethesda, Md., USUHS lecture, "Death Certification," Weedn VW.
62. Sept 95: Quantico, Va., FBI DNA Advisory Board, Weedn VW.
63. Sept 95: University Park, Pa., Pennsylvania State University, Department of Chemistry, "Armed Forces DNA Identification Laboratory: Role in Identification of Military Members," Marino M, Belgrader P.
64. Sept 95: University Park, Pa., Pennsylvania State University, Department of Chemistry, "Future Technologies For DNA Typing," Belgrader P, Marino M.
65. Oct 95: Rockville Md., Basic Forensic Pathology Course, "Aviation Pathology, Gormley WT.
66. Oct 95: Brooks AFB, Texas, Aerospace Medicine Primary Course, "Aviation Pathology," Gormley WT.
67. Oct 95: Wilford Hall USAF Medical Center, San Antonio, Texas, Pathology Resident Conference, "Aviation and Forensic Pathology, Gormley WT.
68. Oct 95: Brooks AFB, Texas, Aerospace Medicine Primary Course, "Aviation Pathology," Gormley WT.
69. Oct 95: Rockville, Md., Basic Forensic Pathology Course, "Courtroom Testimony," Stahl CJ.
70. Oct 95: OSI Regional Homicide Investigation Conference, Randolph Airforce Base, San Antonio, Texas, "Forensic Anthropology and Postmortem Decompositional Changes," Rodríguez WC.
71. Oct 95: Virginia Beach, Va., USPS Investigator's School Bomb Lecture, "Forensic Pathology of Bombs and Explosives," Cogswell SC.
72. Oct 95: Glyncro, Ga., FLETC/ATF Bomb Course, "Forensic Pathology of Bombs and Explosives," Lapa JA.
73. Oct 95: Rockville, Md., AFIP Basic Forensic Pathology Course, "Postmortem Changes and Time of Death," Rodríguez WC.
74. Oct 95: Rockville, Md., AFIP Basic Forensic Pathology Course, "Forensic Entomology," Rodríguez WC.
75. Oct 95: Rockville, Md., AFIP Basic Forensic Pathology Course, "Forensic Anthropology," Rodríguez WC.
76. Oct 95: Rockville, Md., AFIP Basic Forensic Pathology Course, "Forensic Photography," Evoy CE.
77. Oct 95: Rockville, Md., AFIP Basic Forensic Pathology Course, "Sharp Force Injuries," Cogswell SC.
78. Oct 95: Rockville, Md., AFIP Basic Forensic Pathology Course, "Blunt Force Injuries," Cogswell SC.
79. Oct 95: Rockville, Md., AFIP Basic Forensic Pathology Course, "DNA Identification," Weedn VW.
80. Oct 95: Rockville, Md., AFIP Basic Forensic Pathology Course, "Transportation Pathology," Cogswell SC.
81. Oct 95: Rockville, Md., AFIP Basic Forensic Pathology Course, "Aviation Pathology," Gormley WT.
82. Oct 95: Rockville, Md., AFIP Basic Forensic Pathology Course, "Trace Evidence," Junger EP.

83. Oct 95: Rockville, Md., AFIP Basic Forensic Pathology Course, "Mass Disasters," Wagner GN.
84. Oct 95: Rockville, Md., AFIP Basic Forensic Pathology Course, "Explosive Injuries," Wagner GN.
85. Oct 95: Rockville, Md., AFIP Basic Forensic Pathology Course, "Courtroom Testimony," Stahl CJ.
86. Oct 95: Rockville, Md., AFIP Basic Forensic Pathology Course, "Courtroom Presentation," Kilbane E, Ross LG.
87. Oct 95: San Antonio, Texas, Expert Testimony Workshop, Tri-Service Drug Testing Laboratory Biennial Meeting, "Expert Testimony," Smith ML, Turner L.
88. Oct 95: Rockville, Md., Rock Creek Valley School, "Fingerprinting and Forensic Sciences," Anderson TD.
89. Oct 95: Frederick, Md., CE Frederick Conference, "Automated PCR Product Sample Preparation for Capillary Electrophoresis," Marino M, Devaney J, Del Rio S, Turner K, Belgrader P.
90. Nov 95: College Park, Md., University of Maryland, Workshop: Ethical and Policy Issues in Human Genetic Research and Technology, "DNA Identification, DNA Data Banks, and Genetic Privacy," Weedn VW.
91. Nov 95: Gaithersburg, Md., Stedwick Elementary School, "Be a Fingerprint Detective," Cayea CA, Holland JS.
92. Nov 95: Bethesda, Md., ABI/Perkin Elmer Molecular Diagnostics Symposium, "DNA Sequencing and PCR Users Meeting," Weedn VW.
93. Nov 95: Somerset, N.J., The Eastern Analytical Symposium and Exposition, "The Role of Short Tandem Repeats (STRs) in Human Remains Identification," Lee DA, Holland MM, coauthors.
94. Nov 95: Olney, Md., Rosa Parks Middle School, "Career Day: Forensic Sciences and DNA," Diefenbach CA, Morgan MA.
95. Nov 95: Silver Spring, Md., Takoma Park Lions Club, "The DoD DNA Registry," Canik JJ.
96. Nov 95: Rockville, Md., AFDIL, Gettysburg College Genetics Class, Biochemistry Department, "DNA Testing in the Military," Ross J.
97. Nov 95: Washington, D.C., PNA Seminar, "Synthesizing PNA and Their Potential Use for DNA Typing," Girard J.
98. Nov 95: Rockville, Md., Perkin Elmer Symposium on DNA Technologies, "Forensic DNA Typing," Weedn VW.
99. Nov 95: Washington, D.C., Washington Philosophical Society, "DNA Identification of the Last Romanovs," Parsons TJ.
100. Nov 95: San Antonio, Texas, USAF SAM Mishap Investigation Course, "Death Investigation and Autopsy," Cogswell SC.
101. Nov 95: San Antonio, Texas, USAF SAM Mishap Investigation Course, "Death Investigation and Identification," Cogswell SC.
102. Nov 95: San Antonio, Texas, USAF SAM Mishap Investigation Course, "Death Investigation and OSHA Regulations," Cogswell SC.
103. Nov 95: San Antonio, Texas, USAF SAM Mishap Investigation Course, "Death Investigation and Mass Disasters," Cogswell SC.
104. Nov 95: Washington, D.C., DC Medical Examiners Office, "The Role of Forensic Anthropology in Death Investigation," Rodríguez WC.
105. Dec 95: Washington, D.C., American University, "Peptide Nucleic Acids Biotech Applications," Marino M.
106. Dec 95: Bethesda, Md., Uniformed Services University of the Health Sciences, "DNA Applications for Forensic Pathology," Weedn VW.
107. Dec 95: Bethesda, Md., Uniformed Services University of the Health Sciences, "Forensic Pathol-

ogy and the AFME,” Weedn VW.

108. Dec 95: Birmingham, Ala., DNA Databanks and Repositories Course, Armed Forces Institute of Pathology, “DNA Databanks and Repository Survey,” Jimerson NR.
109. Dec 95: Gaithersburg, Md., Chicago Pathology Society, “DoD DNA Registry,” Weedn VW.

RESEARCH

OAFME

The research efforts by staff of the OAFME during CY 1995 not only resulted in numerous presentations at scientific meetings but also in publications in the professional literature. Work has continued on epidemiology of unexpected death in the military, traumatic injury pattern interpretation, and the epidemiology of death by ballistics. Collaborative work with the Department of Cellular Pathology is continuing in the application of graphic image processing to mishap reconstruction and forensic interpretation of injury patterns.

Forensic Toxicology

Significant advances were made in several long-term projects, and more collaborative efforts with outside agencies were developed. Our findings on drug incorporation in hair by infrared microscopy has continued to spur interest, and many outside groups are eager to collaborate and contribute samples. A grant was awarded for continuation of this work. MOU for method development and studies of endogenous morphine induced by surgical stress have continued for another year. Two new projects with MOUs from outside agencies for studying the regional distribution of drugs in brain were performed, one gaining recognition at an international conference. Dr. Kalasinsky was asked to be part of the keynote presentations at the next successive meeting on that topic. Better detection methods utilizing state-of-the-art techniques in tandem mass spectrometry for the analysis of buprenorphine, LSD, and other drugs of abuse are close to completion and will be provided to the DoD drug testing program. Studies for the implementation of steroid testing are underway, and outside collaborators are participating in the work. Studies on interfering substances for the analyses of drugs of abuse were also initiated this year. Other research accomplishments may be gleaned from the list of presentations and publications.

AFDIL

Service and Genetics Systems Branch

The Service and Genetic Systems Branch of AFDIL has successfully supported the OAFME, CILHI, and state and local agencies with DNA testing capabilities. Additional methods have been developed in CY 1995 that have the potential to significantly impact casework efficiency and ultimately productivity and cost.

Two molecular biologists were hired in CY 1994 to further optimize the current testing methods for analysis of mitochondrial DNA (mtDNA), and to develop additional testing systems. New methods have been developed and are in the final stages of validation. These new methods will potentially increase productivity for DNA sequence analysis of mtDNA by 25% to 50%, impacting both reagent and labor costs. This is far greater than earlier projected (20% reduction in reagent costs were projected in late CY 1994). Experiments have been completed that have further optimized the extraction of DNA from human skeletal remains. This has been linked to projects that have increased amplification efficiency, sequencing efficiency, and sequence analysis efficiency.

AFDIL’s aggressive push to further develop methodologies in the mtDNA section reduced the time spent on basic research projects. Proposed projects that have had to wait for completion of other studies are those to determine the extent of DNA degradation in remains collected yearly since 1975, in order to better understand the rates and extent of DNA degradation in skeletal remains; those to extract and characterize DNA from a 2 million-year-old skeletal fragment of an extinct dinosaur, in order to expand AFDIL’s capabilities on skeletal remains that are 20 to 50 years old; and those to evaluate capillary electrophoresis as a method to screen for mitochondrial DNA

sequence matches, before formal DNA sequencing is performed. It is expected that in CY 1996 these projects will come to fruition.

A research and validation project was completed that involved the evaluation of nuclear DNA, short tandem repeat (STR) markers. These markers will be implemented into casework in CY 1996. As a result, AFDIL's DNA identification capabilities will increase significantly.

The Advanced DNA Technologies Development Branch

The Advanced DNA Technologies Development Branch of the AFDIL continues to explore new methodologies and instrumentation for optimizing work performed. The lab is currently synthesizing and testing peptide nucleic acid (PNA) probes, which are analyzed on a matrix-assisted laser desorption/ionization time-of-flight (MALDI-TOF) mass spectrometer. A new method to easily perform multiplex PCR amplification has been developed. This method has been coupled to the ligase detection reaction (LDR) to type 12 loci in a single reaction. The ABI 310 capillary electrophoresis system was purchased, and its DNA sequencing capabilities are being validated.

Research projects follow:

- DNA Typing and Sequencing by Capillary Electrophoresis Using Laser-Induced Fluorescence (LIF) Detection.
- DNA Typing Using the LDR Assay.
- The Analysis of Peptide Nucleic Acid (PNA) Probes Using a Matrix-Assisted Laser Desorption/Ionization Time-of-Flight (MALDI-TOF) Mass Spectrometer.
- Automated DNA Purification, Amplification, and Detection Using a Robotic System.

Ballistics Research Laboratory

The Ballistics Research Laboratory has been operating continuously since a major 6-month refurbishment project was completed on 30 January 1993. Major renovations and equipment changes have made the OAFME ballistic range an extremely important asset for the Institute. The state-of-the-art Passive Snail Bullet Trap installed during the refurbishment period utilizes new design technology and materials, as well as a special "wetting" process never before used in bullet traps. The liquid is self-contained within the unit in a closed system. The liquid acts as a sound-deadening lubrication that facilitates the washdown of the bullet and particles and contains lead dust completely. No other trap in the world even comes close to this design, and the safeguards provided to the shooter are extraordinary. The benefits of this technology are now beginning to come into focus, not only through the safety, which is evident, but also through the interest generated from outside agencies for this technology and the divergent uses in the research arena. The professional Oehler's Model 35P Proof Chronograph was also purchased and installed during the refurbishment period. The laboratory now has the capability to measure and record primary velocity, backup, and proof velocity of all fired rounds. The laboratory also has the ability to record high-shot, low-shot, and extreme-spread velocity. All of the data obtained from the Oehler's Model 35P Proof Chronograph system is then loaded into the Ballistic Explorer terminal software program. This program computes ballistic equations and calculations for muzzle velocity, muzzle energy, and ballistic coefficient measurements. The acquisition of the argon-cooled Palflash 500 pulsed high-illuminance flashlight source system with external pulse trigger has provided advanced capabilities for high-speed photography of ballistic experiments. The benefits of this new technology are now beginning to come into focus through interest generated from outside agencies for this technology and its divergent uses in ballistic research. Research projects follow:

- Gunshot Residue Distribution from Revolver Cylinder Gaps.
- Distribution of Gunshot Residue from Muzzle Flash on Cloth.
- Lead Bullet Wiping on Pig Skin and Angle of Entry.
- Effectiveness of Hollow Point Bullets After Passing Through Secondary Barriers.
- Development of Exemplars of Common Expanding Projectiles for Ballistic Training.

Anthropology Research Laboratory

The Forensic Osteomorphometric Analysis Laboratory continues to perform detailed histological studies of nondecalcified bone via computer-assisted image analysis. This is possible through the utilization of equipment that includes two state-of-the-art Isomet diamond thin-sectioning saws, two Isomet precision polishing units, and a Bio-Quant Computer Imaging Microscopy system. Studies being conducted may lead to a new method for determination of sex, race, and age of an individual from long-bone shaft sections. In addition to the examination of nondecalcified bone, the laboratory also provides assistance to the OAFME through thin-section analysis of geological and man-made materials, which may provide forensically important evidence in air crash or other investigations. The laboratory also maintains a portable Omnichrome alternate light source, which is used in the field and at autopsy in many of the OAFME missions. This tuneable wavelength light source is capable of detecting various types of trace evidence or injury patterns on a body or skeletonized remains that are not visible under normal ambient light. In addition to this laboratory, the Forensic Serology Laboratory and the Forensic Chemistry Laboratory continue to provide outstanding support in the field of forensic pathology. The Serology Laboratory is responsible for conducting various tests that include trace identification of blood, species determination, and blood grouping of highly decomposed tissue samples in order to assist in positive identification of deceased persons. The Forensic Chemistry Laboratory provides identification analysis of materials associated with firearms, as well as other chemicals or compounds collected as trace evidence. Research projects follow:

- Histomorphometric Assessment of Environmental Degradation of Human Long Bone Sections from Vietnam War Dead.
- Development of Rapid Screening Procedure for Histological Differentiation Between Human and Nonhuman Fragmentary Skeletal Remains Utilizing Nondecalcified Thin Sections.

Trace Materials Analysis Laboratory

The Trace Material Analysis Laboratory was established in January 1993 for the purposes of aiding pathologists in the identification of materials associated with medical examiner cases and to serve as a research facility under the auspices of the Special Investigations Division of the OAFME. Since its inception the laboratory has established examination expertise in the fields of soil, hair, and fiber analysis; particle identification; ballistics identification; and microchemical analysis. Associated with this laboratory are components specializing in bloodspatter analysis and computer digitization and animation, both useful in the reconstruction of accident investigations and crime scene analysis. The Division of Special Investigations continued to expand its services with equipment updating of its biometric imaging unit and the purchase of an atomic force microscope.

The Trace Material Analysis Laboratory is equipped with a ballistic/document comparison microscope, a research-grade stereomicroscope, and a transmission/ reflection polarized light microscope. A computer-driven photodensitometer and spectral measurement microscope and alternate-light source illuminator are employed by the lab and by the Forensic Anthropology Section. Acquisition of microchemical reagent blocks and testing equipment mandated the expansion of the laboratory into another laboratory space adjacent to the ballistics range. The acquisition of the atomic force microscope has replaced the need for scanning electron microscopy. Research projects follow:

- Evaluation of the Snail Passive Bullet Trap for the Capture of Projectiles for Forensic Examinations.
- Evaluation of Shotgun Wadding Patterns for Distance Determinations.

PRESENTATIONS AT SCIENTIFIC MEETINGS

1. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Department of Defense Mitochondrial DNA Quality Assurance Program," Weedn VW, Canik JJ, Roby RK, Holland MM.

2. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Estimation of the Mutation Rate of the Human Mitochondrial DNA Control Region," Muniec DS, Ruderman J, Holland MM.
3. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Novel Mitochondrial DNA Testing Program for Human Remains Identification : Laboratory Design and Casework management," Holland MM, Canik JJ, Rhonda RK, Endo Koichi, Kupferschmid TD, Weedn VW.
4. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Analysis of the Data from the College of American Pathologists' Forensic and Parentage Identity DNA Proficiency Testing Programs," Anderson TD, Roby RK, Weedn VW.
5. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "The Use of DNA Analysis to Identify Human Remains from the Waco, Texas Incident," Lee DA, Fisher DL, Ruderman J.
6. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "The Effects of Temperature on Gunshot Residue Patterns as Determined Using a New Method for Pattern Analysis--Photo Densitometry," Cresap TR, Goldman D, Rowe WF, Junger EP, Veasey RC, Hause DW.
7. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "The Effects of Luminol and Coomassie Blue on DNA Typing by PCR," Cresap TR, Pecko JL, Zelif D, Fristoe VL, Moses MA, Ricciardone MD, Ross JP, Roby RK, Fisher DL, Weedn VW, Rowe WF.
8. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Brutality and Bentonite; Hunting a Quarry with a Quarry," Junger EP.
9. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "The Registry of Forensic Pathology: A National Resource," Gormley WT.
10. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Positive Identification and Re-Association Remains Utilizing Radiological, Serological and DNA Comparisons: A Case Report from a Military Aviation Mishap," Rodriguez WC.
11. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Evaluation of Three-Dimensional Range Data for the Examination of Patterned Injury," Oliver WR, Altschuler BR.
12. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "A Tutorial on Image Processing for the Examination of Patterned Injuries," Oliver WR.
13. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Shark Attack," Weedn VW.
14. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Lethal Injuries by Rubber and Plastic Ammunition: The Israeli Experience," Hiss J, Greenberg I, Hellman FN.
15. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Forensic Anthropology at the Federal Level, Within a State/Provincial System, and in Private Practice," Reichs KJ, Rodriguez WC, Sorg MH.
16. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Bee and Wasp Colonization of a Mummified Brain and Its Use in Determination of Time Since Death," Rodriguez WC, Lord WD.
17. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Stability of Ecgonine Methyl Ester in Postmortem Urine Specimens," Levine B, Ramcharitar V, Smialek JE.
18. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Single Point Versus Multiple Point Calibration for the Quantitation of Drugs in Postmortem Blood Specimens," Levine B, Wu SC, Green D, Smialek JE.

19. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Recovery and Examination, and Evidence of Decomposed and Skeletonized Bodies: An Anthropological and Entomological Approach," Rodríguez WC.
20. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Perforated Human Bone at the Hollywood Site (22TU500): A perimortem or Postmortem Phenomenon?" Stallings NR, Rodríguez WC, Junger EP.
21. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Marine Taphonomy of a Case Submerged for 32 Years," Sorg MH, Rodríguez WC, Dearborn J, Sweeney KG, Ryan H.
22. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Human Identification and Composite Analysis after a Fatal F-14A Ejection Sequence," Rodgers L, Junger EP, Veasey RC, Sesterhenn IA, Hellman FN.
23. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Analysis of Fungal Tunneling in 300 Year Old Hair Samples Taken from Burial Lead Coffins," Junger EP, Kunert HF, Hunkler RL, Madary JN, Rowe WF.
24. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, panel member: Strategic Planning Committee Plenary Session, Stahl CJ.
25. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Stability of Ecgonine Ester in Postmortem Urine Specimens," Levine BS, Ramcharitar V, Smialek JE.
26. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, "Single Point Versus Multiple Point Calibration for the Quantitation of Drugs in Postmortem Blood Specimens," Levine BS, Wu SC, Green D, Smialek JE.
27. Feb 95: Seattle, Wash., Annual Meeting of the American Academy of Forensic Sciences, workshop entitled Implementation and Consequences of New DNA Technologies: The Sequel, "Human Identification: From Mitochondrial DNA to High Through-Put Automation," Holland MM.
28. Feb 95: San Francisco, Calif., The International Association of Biological Standardization and the UCSF Department of Laboratory Medicine, Molecular Approaches to Laboratory Diagnostics, "New Developments in DNA Technology," Holland MM.
29. Feb 95: Seattle, Wash., the Annual Meeting of the American Academy of Forensic Sciences, "Mitochondrial DNA Sequence Variability in a Pennsylvania 'Old Order' Amish Population," McDermot MX (FBI), Holland MM, Muniec DS.
30. Mar 95: Rockville, Md., 31st Annual Forensic Dentistry Course, "DNA Profiling," Canik JJ.
31. Mar 95: New Orleans, La., Pittsburgh Conference on Analytical Chemistry and Spectroscopy, "Disposition and Visualization of Drugs in Hair by Infrared Microscopy," Kalasinsky KS, Schaefer T, Smith ML.
32. Apr 95: Oklahoma City, Okla., International Colloquium on Advances in Combustion Technology, "Methodological Considerations in the Interpretation of Postmortem Carboxyhemoglobin," Levine B, D'Nicuola J, Kunsman GW, Smith ML, Stahl CJ.
33. Apr 95: Orlando, Fla., ASCP/CAP 1995 Spring Meeting, "Diagnostics of Molecular Pathology, Update on Principles and Practices," Weedn VW.
34. Apr 95: Orlando, Fla., ASCP/CAP 1995 Spring Meeting, "Medical/Legal Aspects of DNA Testing," Weedn VW.
35. Aug 95: Tulsa, Okla., The 10th Annual Cytogenetics and Molecular Genetics Conferences, "Sequencing of Mitochondrial DNA for Identification of Human Remains," Roby RK.
36. Aug 95: Thessaloniki, Greece, 33rd International Congress on Forensic Toxicology, "Laboratory Methods in Mass Disaster Death Investigations," Smith ML, Lee DA, Rodríguez WC, Stahl CJ.
37. Aug 95: Thessaloniki, Greece, 33rd International Congress on Forensic Toxicology, "Toxico-

- logic Findings in United States Military Aircraft Fatalities 1991-1994," Levine B, Kunsman G, Smith ML, Stahl CJ.
38. Aug 95: Thessaloniki, Greece, The 33rd International Congress on Forensic Toxicology and the 1st Congress on Environmental Toxicology, "Toxicologic Findings in United States Military Aircraft Fatalities 1991-1994," Levine B, Kunsman GW, Smith ML, Stahl CJ.
 39. Aug 95: Thessaloniki, Greece, The 33rd International Congress on Forensic Toxicology and the 1st Congress on Environmental Toxicology, "Blood, Brain and Hair Comparisons for Drug of Abuse Values in Overdose Cases," Kalasinsky KS, Schaefer T, Kish SJ.
 40. Oct 95: Baltimore, Md., Annual Meeting of the Society of Forensic Toxicologists (SOFT), "Simultaneous Assay of Buprenorphine and Norbuprenorphine by Negative Chemical Ionization Tandem Mass Spectrometry," Kuhlman JJ, Magluilo J, Levine B.
 41. Oct 95: Scottsdale, Ariz., The Sixth International Symposium on Human Identification, "Development of a Multiplex Ligation Detection Assay for DNA Typing," Belgrader P.
 42. Oct 95: Scottsdale, Ariz., The Sixth International Symposium on Human Identification, "An Update of the Military's Program of Skeletal Remains Identification Using Mitochondrial DNA Sequence Analysis," Holland MM.
 43. Oct 95: Scottsdale, Ariz., The Sixth International Symposium on Human Identification, "Application of Fluorescent Geneprint™ Multiplex STR Systems and 373 DNA Sequencer Analysis in Forensic Casework," Ricciardone MD.
 44. Oct 95: Scottsdale, Ariz., The Sixth International Symposium on Human Identification, "Validation of the ABI Prism™ STR Primer Sets for Use in a Multiplex System on the 373 DNA Sequencer," Willard JM.
 45. Oct 95: Anaheim, Calif., AMSUS Meeting, "Edward Rhodes Stitt Lecture Award," Weedn VW.
 46. Oct 95: Anaheim, Calif., AMSUS Meeting, Air Force Reserve Dental Workshop, "DNA Forensic Identification," Weedn VW.
 47. Nov 95: Anaheim, Calif., AMSUS Meeting, Society of Air Force Reserve Flight Surgeons, "DNA Forensic Identification," Weedn VW.
 48. Nov 95: San Antonio, Texas, Tri-Service Drug Testing Laboratory Biennial Meeting, "Marker of Poppy Seed Distinguishes Poppy Seed Use from Other Opiates," Paul BD, Dreka C, Knight ES.

PUBLICATIONS

1. Smith ML, Hughes RO, Levine B, Dickerson S, Darwin WD, Cone EJ. Forensic drug testing for opiates. VI. urine testing for hydromorphone, hydrocodone, oxycodone and oxycodone with commercial opiate immunoassays and gas chromatography/mass spectrometry. *J Anal Toxicol.* 1995;19:18-26.
2. DeCoster MA, Klette KL, Knight ES, Tortella FC. Sigma receptor-mediated neuroprotection against glutamate toxicity in primary rat neuronal cultures. *Brain Res.* 1995;671:45-53.
3. Levine B, Smith ML. Stability of drugs of abuse in biological specimens. In: AACC Publications. The Handbook of Workplace Drug Testing. Albuquerque, NM: Sterling Publishing Services; 1995:209-224.
4. Kalasinsky KS, Schaefer T, Binder SR. Forensic application of an automated drug profiling system. *J Anal Toxicol.* 1995;19:412-418.
5. Smith ML, Lee DA, Rodriguez WC, Stahl CJ. Laboratory methods in mass disaster investigations. In: Kovatsis AV, Tsoukali-Papadopoulou H, eds. *Aspects on Forensic Toxicology*. Thessaloniki, Greece: Teenika Studio; 1995:308-314.
6. Levine B, Kunsman GW, Smith ML, Stahl CJ. Toxicologic findings in United States military aircraft fatalities 1991-1994. In: Kovatsis AV, Tsoukali-Papadopoulou H, eds. *Aspects on Forensic Toxicology*. Thessaloniki, Greece: Teenika Studio; 1995:304-307.

7. Levine B, Kunsman GW. Cyanide. *AACC TDM/Tox*. 1995;16:253-269.
8. Aronson KJ, et al. Technial Advisory Committee. Firefighter Autopsy Protocol, FA-156. United States Fire Administration, Federal Emergency Management Agency, May 1995.
9. Belgrader P, Del Rio SA, Turner C, Marino MA, Weaver KR, Williams PE. Automated DNA purification and amplification from blood-stained cards using a robotics workstation. *Biotechniques*. 1995.
10. Clayton TM, Fisher DL, Holland MM, Weedn VW, Whitaker JP, Gill P. Further validation of the Quad 1 STR DNA Typing System: a collaborative effort to identify victims of a mass disaster. *Forensic Sci Int*. 1995.
11. Hayes JM, Budowle B, Fruend M. Arab population data on the PCR-based loci: HLA-DQA1, LDLR, GYPA, HBGG, D7S8, Gc & D1S80. *J Forensic Sci*. 1995;40:888-892.
12. Holland MM, Fisher DL, Roby RK, Ruderman J, Bryson, C, Weedn VW. Mitochondrial DNA sequence analysis of human remains. *Crime Laboratory Digest*. 1995;22:3-8.
13. Holland MM, Roy R, Fraser MD. Serological and DNA methods for the identification of urine specimen donors. *Drugs of Abuse: Methods and Interpretive Issues*. 1995.
14. Holland MM. The role of mitochondrial DNA in forensic identity testing. *Hypervariable Genetic Markers: Nature and Application*. 1995.
15. Marino M, Turni L, Del Rio S, Williams P. The analysis of simple sequence repeat DNA in soybean by capillary electrophoresis. *Journal of Applied and Theoretical Electrophoresis*. 1995.
16. Parsons TJ, Weedn VW. Preservation and recovery of DNA in postmortem specimens and trace samples. *Forensic Taphonomy: The Postmortem Fate of Human Remains*. 1995.
17. Parsons TJ. Diagnosis by random amplified polymorphic DNA polymerase chain reaction of four cryptic species related to anopheles (Nyssorhynchus) Albitarsis (Diptera: Culicidae) from Paraguay, Argentina, and Brazil. *J Med Entomol*. 1995;32:697-704.
18. Smith BC, Holland MM, Sweet DL, DiZinno JA. DNA and the forensic odontologist. *The Manual of Forensic Odontology, American Society of Forensic Odontology*. 1995.
19. Stoneking M, Melton T, Nott J, Barritt S, Roby R, Holland M, Weedn VW, Gill P, Kimpton C, Aliston-Griener R, Sullivan K. *Establishing the Identity of Anna Anderson Manahan*. Nature Genetics. 1995.
20. Weedn VW. State of the art. *The Human Genome Project: Legal Aspects*. 1995:1.

In addition, 10 articles are in press.

Awards

1. Stahl, Charles J., III, Distinguished Fellow Award, American Academy of Forensic Sciences, Seattle, Wash., February 15, 1995.
2. Stahl, Charles J., III, Certificate of Appreciation in Recognition of Outstanding Service as President, 1993-1994, and Chairman of Board of Directors, 1994-1995, National Association of Medical Examiners, San Diego, Calif., October 23, 1995.

GOALS

The OAFME is presently involved in a number of high-visibility projects that will result in increased mission-specific responsibilities. The formulation of Memoranda of Agreement with numerous agencies, such as those with the FBI and State Department, will further define the mission and catchment area of the OAFME. The review and appointment of regional and associate medical examiners will ensure adequate distribution of professional assets throughout the Armed Forces Medical Examiner System.

The Forensic Toxicology Division's purchase of a gas chromatograph/mass spectrometer chem station, which was acquired in CY 1994 for service work, was installed in CY 1995 and networked

to the various laboratory instrumentation. This chem station will eventually have a telecommunication connection to outside laboratories to provide worldwide centralized scientific instrument troubleshooting by our experts. We will continue to provide clinical services with quality results in rapid turnaround times. Research and method development efforts have increased due to the lower clinical workload and will continue as resources allow.

The DoD DNA Registry continues to be recognized as one of the leading laboratories in the use of DNA for human remains identification. To continue this leadership, the following goals are set for CY 1996.

- Continued support to the OAFME, CILHI, state and local agencies with DNA testing services.
- Implementation of the Defense Science Board recommendation for development of a family reference data base and a statistical data base of ethnic/racial populations.
- Development of a Laboratory Information Management Systems (LIMS) to assist with all aspects of case management, processing, and laboratory operations.
- Implement improved security measures for the AFDIL and DNA Specimen Repository.
- Improve testing methods to increase the number and quality services available to requestors.
- Increase productivity as a result of implementing new testing methods and decrease cost, particularly mitochondrial DNA sequence analysis, by 25% to 50%.
- Provide the highest quality DNA testing services available and do so in a professional and economical manner.
- Achieve accreditation from the College of American Pathologists and the American Society of Crime Laboratory Directors.
- Develop automation capability for increased throughput of DNA specimens.
- Continue specimen collections from current active-duty, reserve, and National Guard service members.
- Verify the first 387,500 service member specimens in the DNA Repository against the DEERS data base.
- Establish real-time on-line capability between the DNA Repository and the DEERS data base in Auburn Hills, Michigan.
- Issue final report of the Genetics Process Action Team.